

AD _____

Award Number: MIPR 4EWCDM4057

TITLE: Voice Recognition Interface in the Rehabilitation of Combat Amputees

PRINCIPAL INVESTIGATOR: COL Martha Lenhart
CPT Kathleen E. Yancosek

CONTRACTING ORGANIZATION: Walter Reed Army Medical Center
Washington, DC 20307

REPORT DATE: September 2004

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</small>					
1. REPORT DATE (DD-MM-YYYY) 01-09-2004		2. REPORT TYPE Final		3. DATES COVERED (From - To) 17 Feb 2004 – 30 Sep 2004	
4. TITLE AND SUBTITLE Voice Recognition Interface in the Rehabilitation of Combat Amputees				5a. CONTRACT NUMBER MIPR 4EWCDM4057	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) COL Martha Lenhart and CPT Kathleen E. Yancosek E-Mail: martha.lenhart@amedd.army.mil				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Walter Reed Army Medical Center Washington, DC 20307				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT See abstract in text of report.					
15. SUBJECT TERMS voice recognition, amputee, peripheral nerve loss, dragon software					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USAMRMC
U	U	U	UU	9	19b. TELEPHONE NUMBER (include area code)

TABLE OF CONTENTS

Body

Key Research Accomplishments

Reportable Outcomes

Conclusions

Appendix A: Technical Summary

Appendix B: Funded Personnel and Participants

ABSTRACT

The goal of this pilot study is to assess the impact of training on voice recognition software as part of the rehabilitation process that Military patients with amputation, or peripheral nerve loss to at least one upper extremity, undergo at Walter Reed Army Medical Center, WRAMC. The integration of voice recognition software into a comprehensive rehabilitation program may create new employment opportunities for the upper extremity injured or amputee patients recovering at, WRAMC. The technology of voice recognition software offers a viable alternative for standard computer keyboard operation that the loss of function with one or both hands disrupts.

All patients who participate in this study are trained during their daily occupational therapy appointments, as an extension of the standard of care. Training is done on a longitudinal basis in three phases and includes instruction on software use, actual PC use in the occupational therapy clinic, command memorization, and the opportunity to take a laptop PC out of the clinic for personal use and self-paced instruction.

We expect the results to show that after receiving the training, the patients can stay on Active Duty as an effective part of the fighting force in a support role, enroll in college, operate Environment Control Units, ECU, or gain employment more readily.

BODY

Study Design

The pilot study sought to enroll fifteen upper extremity injured patients to determine their final occupation outcome through written and or phone surveys.

Objective

1. To assess the impact of integrating voice recognition software in the rehabilitation of upper extremity injured patients at WRAMC
 - a. To monitor the final occupational outcome
 - i. Stayed in the Military
 - ii. Enrolled in college
 - iii. Got a job

Background Data

The voice recognition revolution began in 1982, with the introduction of digital audio/voice recognition to the Commodore 64, Atari 400/800, and finally to the IBM PC in the mid 80's. The integration of software into a comprehensive rehabilitation program may create new employment opportunities for the upper extremity amputee patients recovering at Walter Reed Army Medical Center, WRAMC. The technology of voice recognition software offers a viable alternative for standard computer keyboard operation that the loss of one or both hands disrupts. The upper extremity amputee patients at WRAMC may benefit from the integration of speech recognition technology into the health care delivery system.

This study lends opportunity to improve the quality of care through availability, training, and utilization of current computer technologies. An additional corollary is the potential that voice recognition technologies may permeate throughout the AMEDD by employing those injured patients who are trained and remain on Active Duty as viable assets to the fighting force. Finally, the rehabilitation staff involved in the study will be efficient in application and utilization of voice recognition software that may benefit other patient populations, thereby further strengthening AMEDD personnel through the application of technologies.

The uniqueness of the upper extremity injured patient population, as compared to this same population in the civilian world, manifests in several dimensions. First, and most apparent, is that the mechanism of injury is traumatic, as resulting from combat related events. Second, the patients are, on average, much younger and more physically fit than their civilian counterparts. Furthermore, this patient population has hospital lengths of stay that far exceed the civilian hospital, owing partly to the concomitant injuries sustained in battle. The average length of stay at WRAMC is 41.5 days, as compared to four days in a civilian medical center. Once a patient is medically stable and his pain is appropriately muted, the length of time spent in rehabilitation each day may total three hours. This leaves a considerable amount of time convalescing, which can be used to train on voice recognition software, thereby improving their employability, possibly within the Department of Defense.

Methods

Training was provided over a four month period on the voice recognition software in a longitudinal basis and in three phases. The training phases consisted of instructions on software use, command memorization, and opportunities to take the laptop PC's out of the clinic for

personal use.

Phase one consisted of an initial survey to evaluate the participant's baseline computer skills, as well as determine the soldier's future occupational (employment, college, or continued Military service) goals for employment. It was assumed that one's basic computer skills may have contributed to the ability to incorporate voice recognition software usage into one's occupation. Additional variables captured on the pre-enrollment survey were the age, rank, Military Occupational Specialty (MOS), civilian occupation, time in service, ASVAB (Armed Services Vocational Aptitude Battery test) score, permanent home addresses and telephone numbers.

Phase two consisted of practical training on the command structure within the voice recognition software. In order to complete this phase, the participant finished four distinct training modules. The participant's completion of the training modules was tracked as variables based on the number of modules completed. Each module took approximately two hours to complete.

The third phase assessed how the patient translated the training into one's occupation. This phase consisted of a written or phone survey.

Conclusion

The goal was to assess the impact of offering training on voice recognition software as part of their rehabilitation process upper extremity injured patients underwent at WRAMC. The research question was, "What influence on a patient's final occupational outcome does training on voice recognition software have?" The accelerating pace of technology and the demands of rehabilitation converge in synergy through this research venture.

The portable computers and the voice recognition software were kept in the Occupational Therapy clinic, and signed out to patients participating in the study.

Objective

The objective was to assess the impact of integrating voice recognition software into the recovery and rehabilitation course of upper extremity injured patients at WRAMC. Impact is to be measured by the final occupational outcome following his/her Medical/Physical Examination Board, MEB (Medical Evaluation Board). The impact will be described by the proportion of patients who remained in the Army, the proportion of them that went to college, and the proportion of them that got jobs.

Medical Application

Both simple and complicated orthopedic injuries affecting the upper extremities can render a person debilitated and unable to meet typical occupational competencies. These injuries, whether temporary or permanent, create a disability by interfering with a person's capacity to participate in life roles, including job related computer tasks. The World Health Organization, WHO, (2001) recognizes that participation in life is vital to one's health; therefore, an inability to engage in life situations is recognized as a disabling factor.

A powerful and integral occupation in today's society, including the Military, is interfacing with computers. Technology may bridge the gap between disability and health by allowing access to the world by patients otherwise isolated by injury and permanent disability. Voice recognition technology gives therapists the power to offer patients an alternative way to accomplish their

work tasks related to computer use. Moreover, technology can reduce the limitations imposed by orthopedic deficits by creating an alternative way to meet occupational demands. This study was a beginning to evaluate the power of applying advanced technologies within the walls of a rehabilitation setting. The primary objective of this research was to assess the impact of integrating voice recognition software into the rehabilitation of combat-wounded amputee patients.

KEY RESEARCH ACCOMPLISHMENTS

Fifteen active-duty Servicemen/women participated in the study. Initially the study was going to be taught by WRAMC staff after receiving training from a certified Dragon software trainer. The software is very detailed and takes months of practice to become proficient. If the class would have been taught by WRAMC staff, the project would have been less successful. WRAMC staff could not have efficiently taught the program to the patients after only a few hours of "train the trainer" under their belt. You can not replace the confidence and comfort level of a certified Dragon trainer who has ten years of training experience. The professional trainer was able to answer all intricate and user specific questions that arose during the training because most likely the trainer has seen the problem in the past. If staff were in charge the questions and problems would have been new to not only the class but staff as well.

It was very comforting knowing the trainer was willing and able to work so hard to help make the program a success. The training was offered on twenty-one different days with each being at least a two hour class. Classes started on 1 Feb, 2005, and ended on 10 May, 2005. Fifteen active duty service men and women participated in the study receiving over 95 hours of combined instruction.

One patient said, "After trying this program, I realized it will help me be more productive that before my injury. I wish I had this years ago."

Another patient stated, "The voice recognition software was easy to learn and will be a critical part of my future employment opportunities!"

A third patient expressed that, "Dragon was outstanding for me. It enabled me to continue to enjoy the computer. I don't feel like it's a challenge anymore. You get on the computer and just do it. I also maintain the Army "Can Do Attitude". It's just one more reason to remain on active duty. Thanks for providing the best to us".

Study results show that only two patients remained in the Military; six study subjects left the Military and entered college (one patients went to graduate school); one subject got a job as a manual labor worker. One of the patients wrote that his nerve damage had resolved and he has returned to normal keyboard operations. The six that went to college showed the highest satisfaction and use, based on their descriptive comments on the follow up survey. One subject's comment on the final survey was, "By using the software on a daily basis, it makes tasks that use to be difficult, easy. The only thing that was a little difficult was the training of the system to my voice, but once completed I haven't had any issues or problems. Thanks for the great program, it truly is a good tool to have and use."

FY04 AMEDD TELEHEALTH INITIATIVE FINAL REPORT

Patient #		Training Hours	Training Dates - 2005	MEB Date	Follow up Survey Sent	Follow up Survey Rec.
1	MO5101V	10	Feb 1,3,8,10,17	November, 2005	Yes	Yes
2	JW0102V	9	Feb 3,8,10 Mar 3,7	Active Duty	Yes	No
3	LD8506V	5.5	Mar 3,9, 15,	Active Duty	Yes	No
4	JR7507V	7.5	Mar 3,7,9,15	Active Duty	Yes	Yes
5	MO3205V	8	Mar 3,7,9,15	September, 2005	Yes	Yes
6	JF3703V	6.5	Mar 7,9,15,17	Active Duty	Yes	Yes
7	DG9709V	5	Mar 22,24,29,30	Active Duty	Yes	Yes
8	DH0610V	3	Mar 24,29,30	Active Duty	Yes	Yes
9	CS3215V	6	Apr 11,12,19	November, 2005	Yes	Yes
10	BD6414V	7.5	Apr 11,12,18, 19	Active Duty	Yes	No
11	TO7916V	6	Apr 11,18,19	Active Duty	Yes	No
12	JB1613V	7	Apr 11,12,18,19	July, 2005	Yes	No
13	RB8612V	6	Apr 11,12,18,19	November, 2005	Yes	Yes
14	MB1917V	4	May 9,10	Active Duty	Yes	No
15	BK9618V	4	May 9,10	July, 2005	Yes	Yes
		95				

Class I Trainer Hrs

1-Feb	2
2-Feb	2
8-Feb	2
10-Feb	2
15-Feb	2
17-Feb	2
	12

Class II

3-Mar	2.5
7-Mar	2
9-Mar	1
15-Mar	2
17-Mar	2

Class IV

11-Apr	2
12-Apr	2
18-Apr	2
19-Apr	2
	8

Class V

9-May	2
10-May	2
17-May	2
18-May	2
	8

Total Hours 45.5

REPORTABLE OUTCOMES

Study results show that only two patients remained in the Military; six study subjects left the Military and entered college (one patients went to graduate school); one subject got a job as a manual labor worker. One of the patients wrote that his nerve damage had resolved and he has returned to normal keyboard operations. The six that went to college showed the highest satisfaction and use, based on their descriptive comments on the follow up survey. One subject's comment on the final survey was, "By using the software on a daily basis, it makes tasks that use to be difficult, easy. The only thing that was a little difficult was the training of the system to my voice, but once completed I haven't had any issues or problems. Thanks for the great program, it truly is a good tool to have and use."

Using a Wilcoxon Rank Sum Test, there was no statistically significant difference in the hours trained, age, Time in Service, or hours of typical computer use between the nine that completed and returned the follow-up survey and the six who did not. It is however, inferred that those who did not bother to complete the survey were less satisfied with the software, and therefore, it is perhaps a skewed result to summarize the comments of the satisfied nine patients who returned the survey.

CONCLUSIONS

In conclusion, this was a pilot study to investigate the utility of voice-activated software instruction as part of the rehabilitation plans of orthopedically injured and amputated patients. The results demonstrated a usefulness of the software and the training. This was a small study that exemplifies the powerful, amplifying effects that computer technologies can have on Military medical rehabilitative care. Patients who left the Military and returned to college, as well as those who stayed in the Service, reported using the software to accomplish the task of computer use in an alternate way than standard keyboarding; in this way, technology became the equalizing force and filled in the gap between disability and task demands. Occupational therapists are incorporating the training of this software into the standard care plans of upper extremity wounded patients with the knowledge that the skills will become important as the patient renegotiates his vocational future.

APPENDIX A: TECHNICAL SUMMARY

The software and the laptop computers and headsets purchased for this research have been hand-receipted to the occupational therapy clinic where they are being used for the continuation of training on this technology.

APPENDIX B: FUNDED PERSONNEL AND PARTICIPANTS

Funded Personnel:

Barry F. Yancosek
Telemedicine Directorate
FATS Project Manager